

CHANG SHU

Curriculum Vitae, June 2023

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1200 Montreal Road, Ottawa, Ontario, Canada, K1A 0R6

EDUCATION

Sep. 2017–Dec. 2021 **Concordia University, Montréal, Québec, Canada**
Ph.D., Building Engineering
Sep. 2014–Apr. 2017 **Tongji University, Shanghai, China**
M.Sc., Engineering Thermophysics
Sep. 2009–Jun. 2013 **Chongqing University, Chongqing, China**
B.E., Built Environment and Facility Engineering

WORK EXPERIENCE

Mar. 2022–Present **Indoor Air Quality (IAQ) Group,**
National Research Council Canada (NRCC), Ottawa, ON, Canada
Associate Research Officer Supervisor: Dr. Liang (Grace) Zhou.
Aug. 2021–Mar. 2022 **Integrated Building Performance (IBP) Group, NRCC, Ottawa, Canada**
Visiting Worker Supervisor: Dr. Liang (Grace) Zhou, Dr. Iain A Macdonald.
COVID transmission experiments, numerical simulation, and model development
Oct. 2019–Aug. 2021 **Facade System and Products (FSP) Group, NRCC, Ottawa, Canada**
Student Employee Supervisors: Dr. Abhishek Gaur, and Dr. Michael Lacasse.
Generating bias-corrected climate datasets and regional climate modelling (WRF)
May. 2019–Aug. 2020 **Meteorological Research Division,**
Environment and Climate Change Canada (ECCC), Montréal, QC, Canada
Research Assistant Supervisors: Dr. Sylvie Leroyer, Dr. Stéphane Bélair.
Generating land use land cover data for urban area and climate modelling (GEM)
Sep. 2017–Present **Centre for Zero Energy Building Studies (CZEBS),**
Concordia University, Montréal, QC, Canada
Research Assistant Supervisor: Prof. Liangzhu (Leon) Wang.
Sep. 2014–Aug. 2017 **Efficient and Clean Energy Group, Tongji University, Shanghai, China**
Research Assistant Supervisor: Prof. Naiping Gao.

TEACHING EXPERIENCE

Jan. 2021–Apr. 2021 **Concordia University, Montreal, QC, Canada.**
Teaching Assistant **CIVI 6601: Modeling in Building and Environmental Engineering.**
Designed and presented 3 lectures, and tutorials on multiple CFD software.
Answer questions, grade assignments & exams, and guide & grade student projects.
Sep. 2020–Dec. 2020 **Concordia University, Montreal, QC, Canada.**
Teaching Assistant **BLDG 6651: Fire and Smoke Control in Buildings.**
Tutorials on FDS (Fire Dynamics Simulation) and evacuation software.
Answer questions, grade assignments & exams, and guide & grade student projects.
Sep. 2018–Dec. 2018 **Concordia University, Montreal, QC, Canada.**
Teaching Assistant **CIVI 6601: Modeling in Building and Environmental Engineering.**
Responsibilities and activities like the 2nd time in 2021.

Mar. 2016–Jun. 2016 **Tongji University, Shanghai, China.**
Engineering Thermodynamics.
Teaching Assistant Answer questions, grade assignments & exams.

AWARDS & HONORS

Nov. 2022	FRL Director's Award of Excellence at National Research Council Canada
Sep. 2021	Concordia University Conference and Exposition Award (1,200 CAD)
May. 2021	Concordia Accelerator Award (5,000 CAD)
Sep. 2019	Concordia University Conference and Exposition Award (1,000 CAD)
Dec. 2018	Concordia University Conference and Exposition Award (1,000 CAD)
Apr. 2017	Concordia International Tuition Award of Excellence (35,600 CAD)
Sep. 2014	Postgraduate Student Academic Scholarship in Tongji University (3,750 CAD)
Nov. 2012	HITACHI Design Scholarship in Chongqing University (400 CAD)

TECHNICAL SKILLS

CAD/CAE	AutoCAD, Solidworks, SketchUp, Rhino
Meshing	ICEM, GAMBIT, HyperMesh
Climate modelling	WRF and postprocessing in Python, R, NCL, ncView, GrADS, ARWpost, NCO
CFD	ANSYS-Fluent, Star-CCM+, OpenFOAM, ENVI-met, and postprocessing in ParaView, Tecplot, CFD-post
GIS	GDAL, OGR, QGIS, Google Earth Engine (GEE)
Building simulations	EnergyPlus, DeST, eQuest, DesignBuilder, Grasshopper (Honeybee, Ladybug), CONTAM
Fire/Smoke Simulation	Pyrosim (FDS), Pathfinder, FDS
Data analysis	Python, R, Origin, RapidMiner, Excel-VBA
Writing	Markdown, LaTeX, R Markdown
Workflow	Pure (Neo)Vim, Vim emulators in IDEs (VS Code, PyCharm, Rstudio)
Version Control	Git, GitHub, GitLab
Experiments	Wind Tunnel, Particle Image Velocimetry (PIV), Thermal Breathing Manikin, Particle Generation and Particulate Sampling, Tracer Gas, Aerosol Sampling, Sub-scaled Experiment Design, Single-pass Filter Test, Field Measurement of Air Quality and Thermal Environment, Sensor Calibration.
Programming	Python, R, Shell, MATLAB, C/C++, SQL, HTML/CSS, Javascript
Language	English, Chinese

PROFESSIONAL SOCIETIES

Mar. 2018–Present	The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), Member
Jul. 2020–Apr.2022	International Society of Indoor Air Quality and Climate (ISIAQ), Member

JOURNAL REVIEWER, EDITOR

Peer Reviewer	<i>Energy and Buildings</i> (ISSN: 0378-7788), <i>Building and Environment</i> (ISSN: 0360-1323), <i>Urban Climate</i> (ISSN: 2212-0955), <i>Landscape and Urban Planning</i> (ISSN: 0169-2046), <i>Journal of Thermal Biology</i> (ISSN: 0306-4565), <i>Science and Technology for the Built Environment</i> (ISSN: 2374-4731)
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	<i>Energies</i> (ISSN: 1996-1073), <i>Remote Sensing</i> (ISSN: 2072-4292), <i>International Journal of Environmental Research and Public Health</i> (ISSN:1660-4601), <i>Buildings</i> (ISSN: 2075-5309), <i>Sustainability</i> (ISSN: 2071-1050), <i>Atmosphere</i> (ISSN: 2073-4433), <i>Applied Sciences</i> (ISSN 2076-3417)
Guest Editor	Special Issue "Climate Change and Building Energy Efficiency" on <i>Buildings</i>
Guest Editor	Special Issue " Key Technologies of Sustainable Energy System Management: Opportunities and Challenges" on <i>Frontiers in Energy Research</i> (ISSN: 2296-598X)
Guest Editor	Special Issue " New Technologies and Interdisciplinary Studies to Detect and Reduce Viral Transmission Risks in Buildings" on <i>Frontiers in Public Health</i> (ISSN: 2296-2565), and <i>Frontiers in Built Environment</i> (ISSN: 2297-3362)

ACADEMIC SERVICES

Dec. 2020-Jul. 2022	5th International Conference on Building Energy and Environment (COBEE 2022), Concordia University, Montréal, Québec, Canada Conference Chair: Prof. Liangzhu (Leon) Wang, Concordia University.
Conference Staff	Responsible for reviewing papers, publicity of conferences, and managing the website (www.cobee2022.org) and social network.
Scientific Committee	
Session Chairs	Thermal Comfort 1; Building Physics, Building Envelope and Material 8.
Jun. 2022	12th eSim Building Simulation Conference (eSim 2022), Carleton University, Ottawa, Ontario, Canada Conference Chair: Prof. Burak Gunay, Carleton University.
Workshop Instructor	Multi-zone indoor air quality and ventilation modelling with CONTAM (https://carleton.ca/esim22/en_homepage/workshops/)
Apr. 2013	Launching Ceremony of National Centre for International Research of Low-carbon and Green Buildings & Sustainable Built Environment and Green Building Forum, Chongqing University, Chongqing, China Conference Chair: Prof. Baizhan Li, Chongqing University.
Volunteer Leader	Responsible for volunteer group management, and the reception of the attendees.

EXTRA-CURRICULAR

Aug. 2016	International Student Symposium on Power and Mechanical Engineering at Okayama 2016, Okayama, Japan
Short-term International	Okayama University Summer Seminar Program
Exchange	Presentation: An introduction to urban wind and thermal environment simulations

RESEARCH PROJECTS

Apr. 2022- present	Review of the Design and Operation of Inflatable Sports Domes
Project Manager	Funding: Health Canada
Sep. 2021- Present	Assess Priority Technologies and Strategies for Effectiveness and Consequences on Viral Aerosol Transmission
Research Assistant	Supervisors: Dr. Liang (Grace) Zhou. Funding: National Research Council Canada (NRCC).
Apr. 2021- Present	Reducing the Risk of Viral Contagion from the Airborne Transmission of Pathogens within Buildings
Research Assistant	Supervisors: Dr. Liang (Grace) Zhou, and Dr. Michael Lacasse.

	Funding: EUREKA (NOVIRALRISK Eureka Network Project).
Oct. 2019–Present	Climate Resilient Buildings and Core Public Infrastructure
Research Assistant	Supervisors: Dr. Abhishek Gaur, and Dr. Michael Lacasse. Funding: Infrastructure Canada.
Apr. 2019–Present	Assessment and Mitigation of Summertime Overheating Conditions in Vulnerable Buildings of Urban Agglomerations
Team Leader	Supervisors: Prof. Liangzhu (Leon) Wang (PI), Prof. Hua Ge, Prof. Radu Zmeureanu; Funding: The Natural Sciences and Engineering Research Council of Canada (NSERC Advancing Climate Change Science in Canada Program)
Dec. 2020– Present	Air Movement and Control Association (AMCA) COVID White Paper on Un-ducted Fans (including air curtains, ceiling, and circulating fans)
Research Assistant	Supervisors: Prof. Liangzhu (Leon) Wang (PI), Funding: The Air Management and Control Association (AMCA).
Nov. 2017–Nov. 2018	Air Movement and Control Association (AMCA) Project on Air Curtain Energy Performance and ASHRAE Standards 90.1
Team Leader	Supervisors: Prof. Liangzhu (Leon) Wang (PI); Funding: The Air Management and Control Association (AMCA), the Berner International, the Mars Air Systems, the Powered Aire, and the Hickman Group.
Feb. 2018–Aug. 2018	Energy Efficiency and Deicing of Lafontaine Tunnel
Research Assistant	Supervisors: Prof. Liangzhu (Leon) Wang, Prof. Andreas Athienitis (PI); Funding: Ministère des Transports, de la Mobilité durable et de l'Électrification des transports
Sep. 2017–Feb. 2018	Airflow and Thermal Management in NutraPonics Growing System for Quality Food Crop Production
Team Leader	Supervisor: Prof. Liangzhu (Leon) Wang (PI); Funding: NutraPonics Canada Corporation, The Natural Sciences and Engineering Research Council of Canada (NSERC Engage Grants Program).
Nov. 2014–Jun. 2017	Study on the Vertical Pollutant Inter-flat Transmission Mechanism of High-rise Residential Buildings
Research Assistant	Supervisors: Prof. Naiping Gao (PI); Funding: The National Science Foundation of China (No.51278348).
Nov. 2014–Jan. 2016	Urban Microclimate Study Based on Urban Planning Land Function Units
Team Leader	Supervisors: Prof. Naiping Gao; Funding Source: ENN Group Co., Ltd.
May. 2016–Jan. 2017	New Gas Cooktop with Drop-in Sheet Metal Burner Design
Team Leader	Supervisors: Prof. Naiping Gao; Funding: FOTILE Kitchen Ware Co., Ltd.
Jan. 2015–Sep. 2015	Design and Optimize the Air Conditioning of the Passenger Compartments and Heat Exchange of Equipment Compartments on High-speed Train
Team Leader	Supervisors: Prof. Naiping Gao; Funding: CRRC Changchun Railway Vehicles Co., Ltd.
Dec. 2014–Jun. 2015	Performance Evaluation on Sand Filters of High-speed Electric Multiple Units (EMUs) Based on Multiphase Flow Analysis
Team Leader	Supervisors: Prof. Naiping Gao; Funding: CSR Sifang Rolling Stock Co., Ltd.
Jun. 2014–Dec. 2014	Unidirectional Airflow Design with Underfloor Air Distribution (UFAD) System in Ultra-large Area Clean Room
Research Assistant	Supervisors: Prof. Naiping Gao; Funding: Suzhou Purification Technology Co., Ltd.

PUBLICATIONS

Journal Papers

- 2023 **Chang Shu**, Abhishek Gaur, Liangzhu (Leon) Wang, Michael Lacasse, "Evolution of the local climate in Montreal and Ottawa before, during and after a heatwave and the effects on urban heat islands.", *Science of the Total Environment* 890 (2023): 164497
- Jiwei Zou, Henry Lu, **Chang Shu**, Lili Ji, Abhishek Gaur, Liangzhu (Leon) Wang, "Multiscale numerical assessment of urban overheating under climate projections: A review", *Urban Climate*
 - Senwen Yang, Liangzhu (Leon) Wang, Paul Raftery, Michael Ivanovich, Christian Taber, William P. Bahnfleth, Pawel Wargocki, Jovan Pantelic, Jiwei Zou, Mohammad Mortezaazadeh, **Chang Shu**, Runzhong Wang, Scott Arnold, "Comparing Airborne Infectious Aerosol Exposures in Sparsely Occupied Large Spaces Utilizing Large-Diameter Ceiling Fans", *Building and Environment* (2023): 110022
 - Abdelaziz Laouadi, Lili Ji, **Chang Shu**, Liangzhu (Leon) Wang, Michael Lacasse, "Overheating risk analysis in long-term care homes – development of overheating limit criteria", *Buildings* (2023), 13(2):390
- 2022 Lili Ji, **Chang Shu**, Abdelaziz Laouadi, Michael Lacasse, Liangzhu (Leon) Wang, "Quantification of building thermal resilience from summertime extreme heat events.", *Building and Environment*, (2022): 109914.
- Saeed Rayegan, **Chang Shu**, Hamza Mbareche, Jisoo Jeon, Justin Berquist, Patrique Tardif, Liang (Grace) Zhou, Liangzhu (Leon) Wang, Hua Ge, "A Review on Indoor Airborne Transmission of COVID-19 – Approaches and Mitigations", *Journal of Building Engineering*, (2022): 105599.
 - Abdelaziz Laouadi, Lili Ji, **Chang Shu**, Liangzhu (Leon) Wang, Michael Lacasse, "Overheating risk analysis in long-term care homes – development of overheating limit criteria", *Buildings*
 - **Chang Shu**, Abhishek Gaur, Liangzhu (Leon) Wang, Michal Bartko, Abdelaziz Laouadi, Lili Ji, Michael Lacasse, "Added value of convection permitting climate modelling in urban overheating assessments", *Building and Environment*, 207 A (2022): 108415.
 - Lili Ji, Abdelaziz Laouadi, **Chang Shu**, Abhishek Gaur, Michael Lacasse, Liangzhu Wang, "Evaluating Approaches of Selecting Extreme Hot Years for Assessing Building Overheating Conditions during Heatwaves", *Energy and Building*, 254 (2022): 111610
- 2021 Dahai Qi, Senwen Yang, **Chang Shu**, Liangzhu Wang, Andreas Athienitis, "An exploratory study on road tunnel with semi-transparent photovoltaic canopy - From energy saving and fire safety perspectives", *Building Simulation*, (2021)
- Lili Ji, Abdelaziz Laouadi, **Chang Shu**, Liangzhu Wang, Michael Lacasse, "Evaluation and improvement of the thermoregulatory system for a two-node bioheat model", *Energy and Buildings*, 249 (2021): 111235.
- 2020 Abhishek Gaur, Michael Lacasse, Marianne Margaret Armstrong, Henry Lu, **Chang Shu**, Allan Fields, Francisco Salamanca Palou, Yujia Zhang, "Effects of using different urban parametrization schemes and land-cover datasets on the accuracy of WRF model over the City of Ottawa" *Urban Climate*, 35 (2020): 100737

- **Chang Shu**, Liangzhu (Leon) Wang, Mohammad Mortezaazadeh, "Dimensional analysis of Reynolds independence and regional critical Reynolds numbers for urban aerodynamics", *Journal of Wind Engineering and Industrial Aerodynamics*, 203: 104232, 2020
 - Cheng Zhang, Senwen Yang, **Chang Shu**, Liangzhu (Leon) Wang, Ted Stathopoulos, "Wind pressure coefficients for buildings with air curtains", *Journal of Wind Engineering and Industrial Aerodynamics*, 205: 104265, 2020
 - **Chang Shu**, Liangzhu (Leon) Wang, Cheng Zhang, Dahai Qi, "Air curtain effectiveness rating based on aerodynamics", *Building and Environment*, 169: 106582, 2020
- 2017 Di Mu, **Chang Shu**, Naiping Gao, Tong Zhu, "Wind tunnel tests of inter-flat pollutant transmission characteristics in a rectangular multi-storey residential building, part B: Effect of source location", *Building and Environment*, 114: 281-292, 2017.
- 2015 Qiaoxia Yang, Meng Liu, **Chang Shu**, Daniel Mmereki, Md. Uzzal Hossain, Xiang Zhan, "Impact analysis of window-wall ratio on heating and cooling energy consumption of residential buildings in hot summer and cold winter zone in China", *Journal of Engineering*, Vols. (2015), 2015.

Conference Proceedings and Presentations

- 2022 **Chang Shu**, Abhishek Gaur, Michael Lacasse, Liangzhu (Leon) Wang, "Interaction between the Urban Heat Island effect and the occurrence of Heatwaves: Comparison of Days with and without Heatwaves", *5th International Conference on Building Energy and Environment (COBEE 2022)*, Montreal, Canada, July 25-29, 2022
- **Chang Shu**, Zihan Xie, Lili Ji, Daniel Baril, Lin Wang, Xuechen Bai, Senwen Yang, Hua Ge, Radu Zmeureanu, Michael Lacasse, Abdelaziz Laouadi, Abhishek Gaur, Liangzhu (Leon) Wang, "Comparing Multiple Overheating Assessment Metrics Using Measured Data", *5th International Conference on Building Energy and Environment (COBEE 2022)*, Montreal, Canada, July 25-29, 2022
 - **Chang Shu**, Liangzhu (Leon) Wang, "Smoke Spreading Simulation of a High-rise Office building based on Evacuation Analysis", *5th International Conference on Building Energy and Environment (COBEE 2022)*, Montreal, Canada, July 25-29, 2022
 - Lili Ji, **Chang Shu**, Abdelaziz Laouadi, Abhishek Gaur, Michael Lacasse, Liangzhu (Leon) Wang, "Evaluation and mapping indoor thermal risk of older people residing in long-term care (LTC) buildings to local weather conditions", *5th International Conference on Building Energy and Environment (COBEE 2022)*, Montreal, Canada, July 25-29, 2022
 - Lili Ji, **Chang Shu**, Abdelaziz Laouadi, Hua Ge, Radu Zmeureanu, Michael Lacasse, Liangzhu (Leon) Wang, "Quantification of building thermal resilience against heatwaves.", *5th International Conference on Building Energy and Environment (COBEE 2022)*, Montreal, Canada, July 25-29, 2022
 - **Chang Shu**, Abhishek Gaur, Liangzhu (Leon) Wang, Michal Bartko, Lili Ji, Abdelaziz Laouadi, Michael Lacasse, "Impact of Spatial Distributions of Climate Condition on Building Overheating", *REHVA 14th HVAC World Congress (CLIMA 2022)*, Rotterdam, The Netherlands, May 22-25, 2022
 - Lili Ji, **Chang Shu**, Danlin Hou, Abdelaziz Laouadi, Liangzhu (Leon) Wang, Michael Lacasse, "Predicting indoor air temperatures by calibrating building thermal model with coupled airflow networks", *REHVA 14th HVAC World Congress (CLIMA 2022)*, Rotterdam, The Netherlands, May 22-25, 2022

- **Chang Shu**, Abhishek Gaur, Michael Lacasse, Liangzhu (Leon) Wang, “Future projected urban heat island patterns using the Synthesized Representative Urban Effect Preserved (SYRUP) climate dataset”, *3rd International Conference on New Horizons in Green Civil Engineering (NHICE-03)*, Victoria, BC, Canada, April 24 – 26, 2022
- Lili Ji, Abdelaziz Laouadi, **Chang Shu**, Michael Lacasse, Liangzhu (Leon) Wang, “Quantifying building thermal resilience to summertime heatwaves”, *3rd International Conference on New Horizons in Green Civil Engineering (NHICE-03)*, Victoria, BC, Canada, April 24 – 26, 2022
- 2021 Lili Ji, **Chang Shu**, Abdelaziz Laouadi, Liangzhu (Leon) Wang, Michael Lacasse, “Predicting the thermal sensation of older people by integrating a physiological model with a data-driven method”, *Indoor Environmental Quality Performance Approaches (IAQ 2020)*, Athens, Greece, September 13-15, 2021
- **Chang Shu**, Abhishek Gaur, Michal Bartko, Abdelaziz Laouadi, Lili Ji, Michael Lacasse, Liangzhu (Leon) Wang, “Importance of Microscale Climate Simulations in City Scale Overheating Assessments”, *8th International Building Physics Conference 2021*, Copenhagen, Denmark, August 25-27, 2021
- **Chang Shu**, Abhishek Gaur, Lili Ji, Abdelaziz Laouadi, Michael Lacasse, Liangzhu (Leon) Wang, “Analysis of multiple building overheating assessment metrics for long-term indoor thermal patterns in 12 Canadian cities under climate change”, *Building Simulation 2021 Conference*, Bruges, Belgium, September 1-3, 2021
- Lili Ji, Abdelaziz Laouadi, **Chang Shu**, Michael Lacasse, Liangzhu (Leon) Wang, “Physiological modelling of thermal responses of the elderly under heat-stressful conditions”, *Building Simulation 2021 Conference*, Bruges, Belgium, September 1-3, 2021
- Zihan Xie, **Chang Shu**, Ben Zegen Reich, Lin Wang, Daniel Brail, Lili Ji, Senwen Yang, Xuechen Bai, Radu Zmeureanu, Michael Lacasse, Liangzhu (Leon) Wang, Hua Ge, “A field study on summertime overheating of six schools in Montreal Canada”, *8th International Building Physics Conference 2021*, Copenhagen, Denmark, August 25-27, 2021
- Lili Ji, Abdelaziz Laouadi, **Chang Shu**, Abhishek Gaur, Michael Lacasse, Liangzhu (Leon) Wang, “Evaluation and improvement of two-node bioheat model for young subjects”, *8th International Building Physics Conference 2021*, Copenhagen, Denmark, August 25-27, 2021
- Danlin Hou, **Chang Shu**, Lili Ji, Ibrahim Galal Hassan, Liangzhu (Leon) Wang, “Bayesian Calibrating Educational Building Thermal Models to Hourly Indoor Air Temperature: Methodology and Case Study”, *Proceedings of the ASME 2021, Verification and Validation Symposium (VVS2021)*, Virtual, Online, May 19-20, 2021
- 2020 **Chang Shu**, Abhishek Gaur, Lili Ji, Abdelaziz Laouadi, Michael Lacasse, Hua Ge, Radu Zmeureanu, Liangzhu (Leon) Wang, “Building energy consumption and its climate adaptations to future urban extreme heat conditions”, *16th Conference of the International Society of Indoor Air Quality & Climate (Indoor Air 2020)*, Seoul, Korea, July 20-24, 2020
- Lili Ji, Abdelaziz Laouadi, **Chang Shu**, Abhishek Gaur, Michael Lacasse, Liangzhu (Leon) Wang, “A systematic evaluation of indoor overheating interactions with outdoor heat conditions”, *16th Conference of the International Society of Indoor Air Quality & Climate (Indoor Air 2020)*, Seoul, Korea, July 20-24, 2020
- **Chang Shu**, Lili Ji, Lin Wang, Xuechen Bai, Michael Lacasse, Hua Ge, Radu Zmeureanu, Liangzhu (Leon) Wang, “Field survey on indoor overheating in school and hospital buildings in Montréal”, *2nd International Conference on New Horizons in Green Civil Engineering (NHICE-02)*, Victoria, BC, Canada, August 24 – 26, 2020

- Liangzhu (Leon) Wang, **Chang Shu**, Hua Ge, Radu Zmeureanu, Michael Lacasse, Sylvie Leroyer, Stephane Belair, Lili Ji, Xuechen Bai, Lin Wang, Mohammad Dorostkar, Ali Katal, "Assessment of summertime overheating conditions in vulnerable buildings in Montréal", *2nd International Conference on New Horizons in Green Civil Engineering (NHICE-02)*, Victoria, BC, Canada, August 24 – 26, 2020
- 2019 **Chang Shu**, Liangzhu (Leon) Wang, "Revisiting Reynolds independent phenomenon by dimensionless CFD analysis of urban and built environment airflows", In *Proceedings of 11th International Symposium on Heating Ventilation and Air Conditioning (ISHVAC 2019)*, Harbin, China, July. 12-15, 2019
- Liangzhu (Leon) Wang, **Chang Shu**, "Dimensionless CFD analysis of Reynolds independence and similarity in urban and built environment airflows" In *Proceedings of 2019 ASHRAE Annual Conference*, Kansas, United States of American, June. 24-25, 2019
- 2018 **Chang Shu**, Liangzhu Wang, Andreas Athienitis, "Deep learning of a real road tunnel energy demand using recurrent neural networks", In *Proceedings of 4th Asian Conference of International Building Performance Simulation Association (ASIM 2018)*, Hong Kong, China, December. 3-5, 2018
- **Chang Shu**, Cheng Zhang, Dahai Qi, Liangzhu (Leon) Wang, "Novel method relating air curtain aerodynamic performance to its effectiveness", In *Proceedings of 4th Asian Conference of International Building Performance Simulation Association (ASIM 2018)*, Hong Kong, China, December. 3-5, 2018
- 2016 **Chang Shu**, Cheng Wang, Jifu Xu, Naiping Gao, "Microclimate modelling of typical land use units with different arrangements: a case study in Langfang", In *Proceedings of 8th Asian Conference on Refrigeration and Air Conditioning (ACRA 2016)*, Taipei, Taiwan, China, May. 15-17, 2016.

Conference Presentations (Abstract Only)

- 2021 **Chang Shu**, Abhishek Gaur, Michael Lacasse, Liangzhu (Leon) Wang, "Statistical–dynamical High-Resolution Modeling of the Ottawa–Montreal Regional Climate", *101st American Meteorological Society Annual Meeting (AMS 2021)*, Virtual, January 12-15, 2021
- **Chang Shu**, Abhishek Gaur, Michael Lacasse, Liangzhu (Leon) Wang, "Modeling Outdoor and Indoor Overheating Conditions during an Extreme Overheating Event in the Ottawa–Montreal Region", *101st American Meteorological Society Annual Meeting (AMS 2021)*, Virtual, January 12-15, 2021

Books/Chapters

- 2020 Liangzhu (Leon) Wang, **Chang Shu**, "Chapter 2: Assessment of the Effect of Urban Heat Island on Buildings", *Urban Heat Island Mitigation – in Hot and Humid Cities*, Springer.

Technical Reports (in English only)

- 2022 Liangzhu (Leon) Wang, Sepehrdad Tahmasebi, **Chang Shu**, Senwen Yang, "AMCA COVID Guidance for UNDUCTED Fans – Modeling Air Curtains". The Air Movement and Control Association (AMCA). Pages: 32, September 2022
- 2021 Liangzhu (Leon) Wang, Senwen Yang, Runzhong (Alvin) Wang, Mohammad Mortezaazadeh, Jiwei Zou, **Chang Shu**, "AMCA COVID Guidance for UNDUCTED Fans – Modeling Ceiling Fans". The Air Movement and Control Association (AMCA). Pages: 39, September 2021
- 2020 **Chang Shu**, "Generating climate datasets and WRF modelling". National Research Council Canada (NRCC), Pages: 105, March 2020

- 2018 Liangzhu (Leon) Wang, **Chang Shu**, “Air curtain project – evaluation and application of existing air curtain effectiveness methodology – relating aerodynamics performance to air curtain effectiveness – AMCA Air Curtain Project Phase V”. The Air Movement and Control Association (AMCA). Pages: 68, December 2018
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Submitted Papers

- 2023 Xie Chen, Yongqiang Luo, Zhiyong Tian, Hongzhi Mao, Jinghua Yu, Jie Deng, Liguang Jiang, Zhi Cao, **Chang Shu**, Bin Hu, Jianhua Fan, “Increase in solar irradiance during the COVID-19 pandemic identifies potential of future PV performance”, *Applied Energy*.
- Sepehrdad Tahmasebi, Liangzhu (Leon) Wang, **Chang Shu**, Senwen Yang, “AMCA COVID Guidance for UNDUCTED Fans – Air Curtains”, *11th International Conference on Indoor Air Quality, Ventilation & Energy Conservation in Buildings (IAQVEC 2023)*, May 20-23, 2023, Tokyo, Japan.
 - **Chang Shu**, Yu-Hsuan (Vicky) Wang, Liang (Grace) Zhou, “An Exploratory Study of Airflow Patterns surrounding HEPA Portable Air Cleaners using Particle Image Velocimetry”, *13th Nordic Symposium on Building Physics (NSB 2023)*, June 12-14, 2023, Aalborg, Denmark.
 - Shengwei Fu, Shujie Yan, **Chang Shu**, Justin Berquist, Liang (Grace) Zhou, Liangzhu (Leon) Wang, “Multizone Modelling of Airborne SARS-CoV-2 Quanta Transmission and Risk Assessment under Different Mitigation Strategies in Selected Buildings”, *Healthy Buildings 2023 Asia and Pacific Rim*, July 16-19, 2023, Tianjin, China
 - **Chang Shu**, Abhishek Gaur, Michael Lacasse, Liangzhu (Leon) Wang, “Synthesized Representative Urban Effect Preserved (SYRUP) climate dataset for future projection of urban heat island”, *(Under Preparation)*